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USAF UNDERGRADUATE PILOT TRAINING PASS/FAIL RATES OF SPECTACLED-VERSUS-NONSPECTACLED STUDENT PILOTS

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USAF SCHOOL OF AEROSPACE MEDICINE
Aerospace Medical Division (AFSC)
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NOTICES

This final report was submitted by personnel of the Ophthalmology Branch, Clinical Sciences Division, and the Data Sciences Division, USAF School of Aerospace Medicine, Aerospace Medical Division, AFSC, Brooks Air Force Base, Texas, under job order 7755-24-01.

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The Office of Public Affairs has reviewed this report, and it is releasable to the National Technical Information Service, where it will be available to the general public, including foreign nationals.

This report has been reviewed and is approved for publication.

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Among 2348 U. S. Air Force undergraduate pilot training (UPT) students, no statistical difference (.05 level) in the pass/fail rates was found between students who initially failed tests for distance visual acuity, color vision, and red lens and students who passed these tests on the first administration. These findings suggest that UPT pass/fail rates are not influenced by the presence/absence of any of the visual anomalies. We must caution, however, against extrapolating these findings to operational flying, particularly in high-performance aircraft or to the skill level attained except to complete the training.

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USAF UNDERGRADUATE PILOT TRAINING PASS/FAIL RATES OF SPECTACLED-VERSUS-NONSPECTACLED STUDENT PILOTS

INTRODUCTION

The primary purpose of this investigation was to determine if USAF undergraduate pilot training (UPT) failure rates differed between student pilots requiring corrective lenses and those not requiring lenses. We also sought to determine whether the two groups differed with respect to the reasons for failure (i.e., flying deficiency, academic deficiency, self-initiated exit). Finally, we wanted to study the relationships between certain vision deficiencies (i.e., color vision and the red lens test) and UPT pass/fail rates.

Visual standards requirements for USAF UPT specify 20/20 unaided visual acuity (VA) for each eye (1). Waivers may be granted, however, for unaided VA up to but not exceeding 20/50* if it is correctable to 20/20. A 1980 Air Force-wide sample survey of approximately 2000 Air Force aircrew members showed that 20% of the pilots and 50% of the navigators were required to wear corrective lenses (2).

Modern avionics provide essential informational assistance to the aircrew member. Yet, visual performance, in and out of the cockpit, continues to be a most critical component of combat mission success. The question of whether aircrew members who must wear corrective lenses perform flight duties as well as those not requiring a correction has not been satisfactorily answered.

METHODS

Computer printouts of flying training master records were obtained from the Air Training Command headquarters at Randolph Air Force Base, Texas. These records were of 3237 students who exited UPT either by graduation or by failure to complete training during fiscal years 1980 and 1981. Data retrieved included name, social security number, UPT entrance date, student source training base, UPT exit date, and reason for exit.

A search was made at Physical Evaluation Section, Air Training Command headquarters, for the physical examination records (AF Form 88) of the students.** Matches were made for 2348 students (534 Air Force Academy

* See AFR 160-43. A very limited number of waivers were granted to outstanding individuals with VA worse than 20/50.

** Physical examinations performed no earlier than 9 months before entry into UPT were required for Air Force Academy graduates. Examinations were required for all others upon entry into UPT.

graduates, 335 Officer Training students, 826 ROTC students, and 653 others), and our investigation is based on these students. From the AF Form 88 records the following visual examination data were extracted for each eye: unaided distance visual acuity, unaided near visual acuity, and cycloplegic refraction. Also recorded were distance heterophoria (horizontal and vertical), near point of convergence, amplitude of accommodation, visual fields, color vision, depth perception, and red lens test results. Names and social security numbers were used only for data matching and do not appear on any results or reports. All data were key-punched for computer processing.

RESULTS

Our data showed that 14.2% of the student pilots required corrective lens wear upon UPT entry. For Air Force Academy graduates the percentage of wear was 36.3%, for ROTC 6.2%, for OTS 4.5%, and for all others 11.3%.

Table 1 shows the pass and failure rates for the spectacle wearers and nonwearers, with the failures broken out by reason for failure. Of the eyeglass wearers, 72.8% graduated UPT and of the nonwearers, 70.7% graduated UPT.*

TABLE 1. UPT PASS/FAIL RATES FOR SPECTACLED AND NONSPECTACLED STUDENT PILOTS

	% Failed UPT				% Passed UPT
	Flying deficiency	Academic deficiency	Self exit	Other	
Glasses (n = 334)	18.3%	1.2	4.2	3.6	72.8
No glasses (n = 2014)	15.6	1.0	6.9	5.8	70.7
Total (n = 2348)	16.0	1.1	6.5	5.5	71.0

* These rates are biased below the true USAF UPT graduation rate (e.g., 80.6% in FY81) because early 1981 failures in the 49-week course showed on the master records at the time we sampled, whereas those that eventually graduated were not yet in the records. However, this does not invalidate the comparisons between eyeglass and noneyeglass wearers.

These percentages did not differ statistically at the .05 level (Chi Square = 0.58). However, there was borderline evidence (P<.10, Chi Square = 6.83) that the distribution among the four reasons for failure was not the same for the spectacle wearers and nonwearers. The spectacle wearers were slightly higher in the "flying deficiency" category and slightly lower in the "self exit" and "other" categories.

The distribution of right eye refractive errors, expressed in spherical equivalent (SPEQ) units,* is shown in Figure 1 for students requiring glasses for far vision (left eye results were very similar and are therefore not shown).

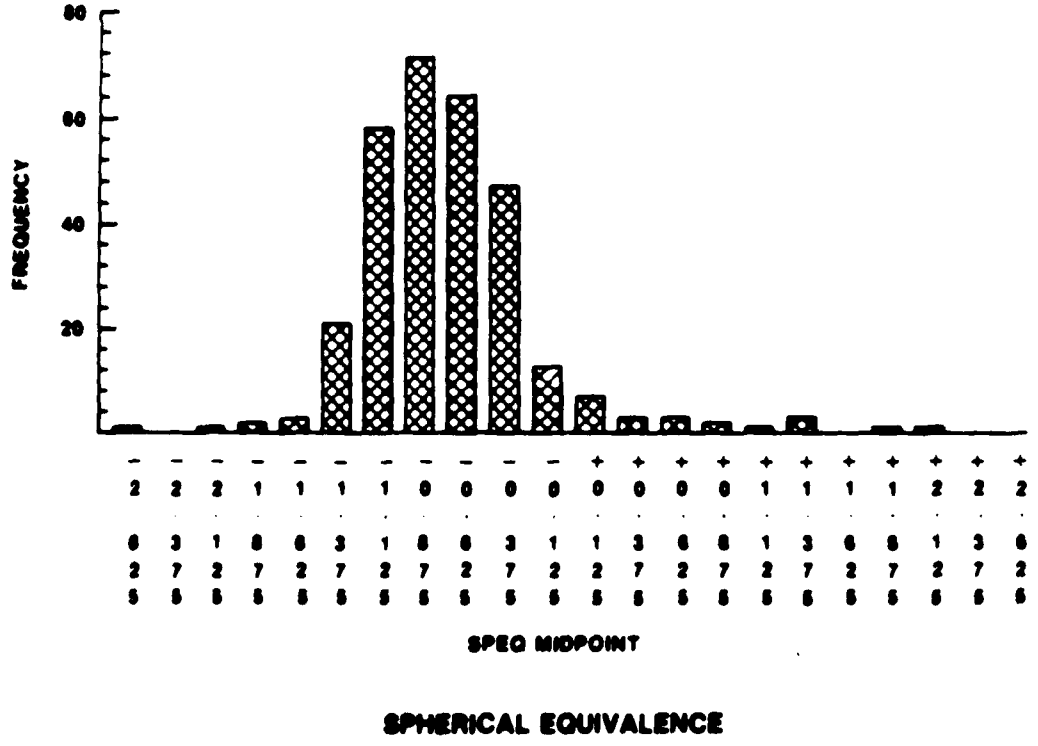

Figure 1. Distribution of spherical equivalence in students requiring glasses for far vision (right eye).

* The spherical equivalent is the algebraic sum of the sphere component and one-half of the cylinder component.

SPEQ ranged from -2.50 D. to +2.125 D., with a median value of -0.75 D. For comparison, mean SPEQ error for all spectacled USAF pilots is -0.50 D (2). To determine whether UPT pass/fail rates were related to SPEQ values, spectacle wearers were divided into 3 groups according to the degree of SPEQ error, and the UPT passing rates of these groups were then compared (Table 2). No significant differences were found at the .05 level.

TABLE 2. RELATIONSHIP OF UPT PASS/FAIL RATES TO SPHERICAL EQUIVALENCE OF STUDENTS REQUIRING GLASSES FOR FAR VISION (RIGHT EYE ONLY)

SPEQ(D)	N	% Passing UPT	
$\leq$ -0.75	157	73.9	
-0.749 to -0.001	121	75.2	Chi Sq = 0.32 (NS)
$\geq$ 0.0	24	79.2	

The distribution of unaided visual acuity (VA) of students requiring glasses for far vision is shown in Figure 2. We are reporting the "upper

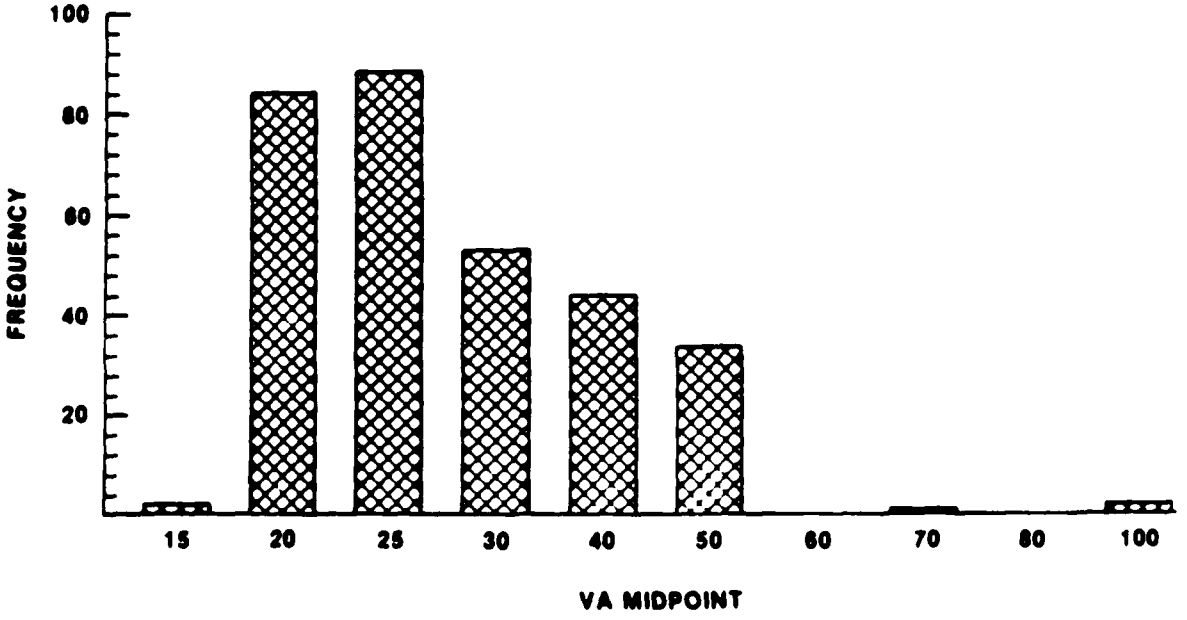

Figure 2. Distribution of visual acuity in students requiring glasses for far vision. Visual acuity was selected from the better of the two eyes for each student.

bound" of VA (i.e., we selected the better of the left and right VAs for each student), under the assumption that a student's vision is determined primarily by his better eye.* Unaided VA ranged from 20/15 to 20/100, with a median of 20/25. To determine whether UPT pass/fail rates were related to unaided VA, spectacle wearers were divided into 3 groups according to the magnitude of their visual acuity, and the UPT passing rates of these groups were then compared (Table 3). No significant differences were found at the .05 level. The "lower bound" of VA (i.e., selecting the worse of the left and right VAs) was also studied, but the test results were nearly identical and are therefore not included.

TABLE 3. RELATIONSHIP OF UPT PASS/FAIL RATES TO VISUAL ACUITY OF STUDENTS REQUIRING GLASSES FOR FAR VISION. HERE, THE BETTER OF THE LEFT AND RIGHT VISUAL ACUITIES WAS USED FOR EACH STUDENT.

Visual acuity	N	% Passing UPT	
$\leq$ 20/20	86	70.9	
20/25 to 20/30	141	73.8	Chi Sq = 1.03 (NS)
> 20/30	81	77.8	

As a secondary issue, we decided to investigate the effects of deficiencies in the red lens test and color vision on UPT pass/fail rates. For each of these, the subjects were grouped according to whether they passed or failed the initial test given to them.** In each case, the passing rates of the two groups were then compared (Table 4). No significant difference was found at the .05 level in any case.

* A student with 20/15 or 20/20 in his better eye will show on Fig. 2 if his other eye is less than 20/20 and he must wear glasses.

** Failing the initial color vision tests does not necessarily disqualify a UPT candidate, but does require further assessment of their status. Assessment may include a readministration of the test or administration of comparable tests. Passing the red lens test is not a requirment for UPT.

TABLE 4. RELATIONSHIP OF UPT PASS/FAIL RATES TO EACH OF TWO VISION CONDITIONS, USING ALL STUDENTS IN THE STUDY.

Test	Test result	N	% Passing UPT	Chi Sq (P)
Color vision	Pass initial test	2303	71.2	0.75 (NS)
	Fail initial test	43	65.1	
Red Lens	Pass initial test	2339	71.1	0.06 (NS)
	Fail initial test	6	66.7	

DISCUSSION

The U.S. Army conducted a similar study of primary flight training students during their first 16 weeks of training (3). No significant difference, academic or in-flight performance, was reported between spectacled-versus-nonspectacled students. Several studies were done in Canada during World War II addressing reduced visual acuity and student pilot performance. Those reports are unfortunately yet classified. Other reports of corrective lens wear requirements among pilots were inconclusive (4,5).

The results of this and other studies should not be construed to indicate that aircrew spectacle wear does not create problems. Factors such as sweat on lenses, peripheral vision disturbances, reflections, and protective equipment incompatibility may affect flight performance. Aircrews of high performance aircraft in operational conditions are particularly vulnerable to such factors. Efforts are continuing to determine relationships of visual function to operational flight performance. Results will provide meaningful information to help resolve the important issue of corrective lens wear requirements in military aircraft.

CONCLUSIONS

Data analysis revealed that of 2,348 students entering UPT 14.2% required corrective lenses. No statistical difference existed in the pass/fail rate between spectacled-versus-nonspectacled student pilots. There was a suggestion (though not significant at the .05 level) that the two groups distributed differently with respect to the reasons for failure. The pass/fail rate was essentially the same between students who initially failed the red lens test or color vision tests and students who passed these tests on initial administration.

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